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Author Philip C. Johnson

TITLE

RESULTS OF SOME METHODS USED TO TEACH THE PRINCIPLES AND USES OF THE PONDEROSA PINE RISK RATING SYSTEM

By Philip C. Johnson, Entomologist

Forest Insect Laboratory
Coeur d'Alene, Idaho

SUBJECT—

INDEX NO.—

UNITED STATES DEPARTMENT OF AGRICULTURE

BUREAU OF ENTOMOLOGY AND PLANT QUARANTINE

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June 21, 1951

To: J. C. Evenden, in Charge, Coeur d'Alene laboratory

From: F. P. Keen, in Charge, Berkeley laboratory

Subject: Ponderosa Pine Risk Rating Schools

Phil Johnson's report on the results of teaching the principles and uses of the ponderosa pine risk rating system and the accompanying correspondence has been read by us with much interest.

It is obvious that Phil has done a thoroughly conscientious and well planned job of instructing a large group of field men in risk rating procedures, with the usual difficulties of getting uniformity in a system which necessarily depends so largely on interpretation of rather intangible characters and personal judgment.

I have no question but what a good selling job has been done, but am somewhat fearful that the sales job is superior to the product being offered.

In applying the principles of risk rating there are several steps in which major errors may occur; i.e.

(1) In the setting of standards or weights to be used in judging the significance of different tree characters.
(2) In adjusting those standards to different sites, and different ecological subregions of the ponderosa pine type.
(3) In personal bias of the expert or instructor in interpreting or applying standards.
(4) In personal bias or misinterpretation on the part of the pupil in following the instructions of the teacher.

In the present case emphasis is being placed on eliminating errors under step (4), apparently on the assumption that errors under (1), (2) and (3) have all been reduced to a comparable level. Actually this hasn't been done.

The ten-year loss record from the Oregon 10-acre risk plots is showing that we are going to have to make some major changes in the weighing of different risk characters from the preliminary weights given these when they were first set up on a purely empirical or personal judgment basis. We now have an experience record to go by, so the old standards are no longer entirely valid.

I quite agree with Furniss' comments and wish to assure him that no "certified standards" are on deposit in Berkeley; that for eastern Oregon conditions such preliminary ratings as were set up are now being changed to conform with experience records, and even if we did have soundly established standards, they would not necessarily apply without modification to a new ecological region. It is much too early to talk about "accuracy" or to preach the gospel of risk rating as though it were based on any final ten commandments.

The next thing which should be done is to carry on similar studies in the Idaho region to see how the California standards should be modified by conditions in this new ecological zone.

After a sound basis has been established for recognizing risk trees, as demonstrated by mortality records in the Idaho region, then schools can be conducted with confidence that what is being taught has validity for the stands in question. Otherwise, it seems to me we are not getting first things first.

Another point on which caution is needed is in regard to the length of time that risk ratings are valid in indicating the group of trees in which mortality can be expected to occur. The Oregon plots have shown how rapidly the risk rating may break down and that this appraisal is most useful in taking out loss during the first five-year period. In contrast to this the susceptible tree classes hold up consistently through this period and hence are more useful for cuttings which are expected to give protection for over five years. The following table is from the 7-year mortality experience on the Oregon plots.

Year after Coding	No. of trees	Percent of killed trees falling in Different Classes: Risk 1	Risk 2	Risk 3	Risk 4	Non-Susceptible A & B trees (exc. 4B)	Susceptible Tree Classes C & D & 4B
0	12	-	-	17%	83%	17%	83%
1	21	-	10%	14	76	10	90
2	23	-	17	26	57	17	83
3	31	-	16	32	52	13	87
4	41	22%	26	15	37	29	71
5	33	3	15	36	46	33	67
6	14	14	36	29	21	14	86
7	12	25	42	17	16	15	75

From the data given in Table 1, I seriously question the validity of Risk 3, including 26 to 28 percent of the stand, as having the same significance in mortality as Risk 3 in this region where it comprises about 10 to 15 percent of the stand. When we talk about degrees of risk, we are referring to the relative chance of mortality occurring in a given group. Unless mortality is running over twice as high in Idaho stands as here, Risk 3 would not have the same meaning even though the outward characters were the same.

Jack Bongberg has read Johnson's report but has been so busy getting the survey work started and the "bug schools" organized that he has not had a chance to comment. He may get a chance to do so later.

P. S. Dr. Beal's comments of June 13 just came in and I see we are both concerned about the same thing.

cc: Dr. Beal
Portland
Ogden
Fort Collins

UNITED STATES DEPARTMENT OF AGRICULTURE
AGRICULTURAL RESEARCH ADMINISTRATION
BUREAU OF ENTOMOLOGY AND PLANT QUARANTINE
Forest Insect Laboratory
Coeur d'Alene, Idaho

File No.
Noted by
RLF
JW
WKC
KHW

May 28, 1951

To: R. L. Furniss, In Charge, Portland Forest Insect Laboratory

From: J. C. Evenden, In Charge, Coeur d'Alene Forest Insect Lab.

Subject: Ponderosa Pine Risk Rating Schools

I enjoyed your comments on Mr. Johnson's report of the ratings or results obtained from the risk rating schools held in this region, which we appreciate. We feel that these schools have been worthwhile and have filled an important need. They have been well received, and those who attended have voiced their appreciation. We now know that the men charged with the marking of ponderosa pine are all speaking the same language.

Your question as to the use of the word "accuracy" is well taken. Your question actually asks what is an "accurate" rating and who is to set the standard. At our schools the test trees were marked to the best of our ability. I know that Mr. Johnson would not claim that they were perfect, or that his decisions would be in accord with all of the other so called experts. However, someone must assume the responsibility of saying "this is it". Obviously, and fortunately, there will be differences of opinion between men of the same ability and who have had equal training. However, when the classification is understood, such differences are of no great moment as they will be borderline cases that can go either direction. The high and low points of the classification range for each area are not difficult to determine. When this range is broken into several classes there will always be differences of opinion by the individuals making the decision. When these differences occur at a point in the classification range, that separates the "takes" and the "leaves", it is important. We recognize that this dividing line unless watched carefully can be serious.

Thanks again for your comments, which we do appreciate.

James C. Evenden

cc: Dr. Beal
Berkeley
Ogden
Fort Collins

J. C. Evenden, In Charge, Coeur d'Alene Laboratory   May 24, 1951

R. L. Furniss, Entomologist, Portland Laboratory

Report - Results of Some Methods Used to Teach the Principles and Uses of the Ponderosa Pine Risk Rating System by P. C. Johnson

JWW
WKC
KHW

Johnson's well prepared and informative report re-emphasizes the fact that there is no satisfactory substitute for experience in the application of the ponderosa pine risk rating system. Schools such as those being held in Region 1 should go a long way in getting the system into actual practice.

In reading the report and studying the tables, I wondered a little about the use of the word "accuracy". One could easily get the impression that the trainees were confronted by fifty tried and true risk trees all in perfect agreement with certified standards on deposit in Berkeley. Yet Eaton has shown that even the experts fall considerably short of agreement in designating risk trees. Presumably the fifty trees in each of the reported tests were rated by an expert, himself fallible in some degree. Thus some of the differences on the part of the trainees were not necessarily the result of error.

As you point out in your memorandum of transmittal one of the most important things is the degree of agreement in the marking of risk trees to be removed. Indeed this is the crux of the matter. It would have been informative to show to what extent the trainees agreed upon the designated high risk trees.

cc: Dr. Beal
Berkeley
Ogden
Ft. Collins

RLFurniss:AH

File No.
Noted by RLF

Forest Insect Laboratory
Coeur d'Alene, Idaho

May 18, 1951

To: J. A. Beal, In Charge, Forest Insect Investigations

From: James C. Evenden, Box 630, Coeur d'Alene, Idaho

Subject: Training Schools - Ponderosa Pine Risk Rating

Last season (1950) two ponderosa pine risk rating schools were held in Region One, under the direction of the Coeur d'Alene Laboratory. The program for these schools was planned at this laboratory, and approved by the Forest Service Training Officer at Missoula, Montana. Mr. Johnson conducted these schools, and we received some nice compliments concerning them.

The enclosed report by Mr. Johnson discusses the results of the training effort at the two schools as determined largely from the tests given to the trainees. It would seem that the average percentages of correctly rated trees given in Table 2 (67 and 65 respectively) are disappointingly low. Certainly we would like to see these averages raised in future schools and the recommendations listed at the bottom of page 5 are calculated to do this. From the results obtained at the third risk school in Grangeville last week we know that they will.

The results in Table 2, however, are not as bad as they might seem. The average number of correctly rated trees is not out of line with Eaton's 1942 findings for persons of comparable risk rating experience, as is pointed out on page 4 of Mr. Johnson's report. Then, too, there is always the personal factor met within any school. Some make a real effort to learn all that can be learned, while some have more difficulty in grasping the fundamental principles of the subject being taught. Mr. Johnson is of the opinion that the risk rating system is most easily comprehended by men who have had considerable experience in ponderosa pine timber marking under some form of silvicultural or economic tree classification. The two schools reported upon here were attended by some whose experience in this field varied from little to almost none.

However, as is brought out in paragraph 3, page 4, the average trainee from the two schools could turn in a very creditable job in using the risk rating system as the basis of a cutting designed to remove the high

risk trees from a stand. The average trainees distribution of ratings applied to the 50 test trees, shown in Table 3, is very close to the actual distribution of rated trees. There were 19 high risk trees in the test stands used by the two schools and in one the average trainee would remove 19 and, in the other, 20. This comparison is open to criticism, of course, from the standpoint that the 19 and 20 trees rated by the trainees at the two schools may not necessarily have included the same 19 trees actually known to be high risk.

This all comes back to the fact that we must improve our training so that the average percentage of correctly rated trees, shown in Table 2, is as high as it is possible to get it. I feel confident that the recommended improvements in training procedure will bring about a better understanding of the rating system by the trainees at any future schools of this kind.

cc: Regional Office (Timber Mgt.)
" " (Mr. Sandburg)
Portland
Berkeley
Ogden
Fort Collins

RESULTS OF SOME METHODS USED TO TEACH THE PRINCIPLES AND USES OF THE PONDEROSA PINE RISK RATING SYSTEM

By Philip C. Johnson, Entomologist

INTRODUCTION

The application of the ponderosa pine risk rating system is often marked by a lack of close adherence to the published rating (2) and of uniform interpretation by those who apply it. Eaton (1) has shown that 1) the ability of a person to rate trees properly varies with his experience, 2) even with considerable experience one cannot hope to gain much more than 80 percent accuracy, 3) untrained persons cannot satisfactorily apply risk ratings guided only by the published description of the system, and 4) the discrepancies in risk ratings made by different persons may be accounted for by the fact that the discernment of tree crown characters is not critical enough. The latter point is substantiated by the findings of Wygant (3) whose study showed that the estimates of needle length--one of the indices of risk--are subject to much error. Estimates of other crown characters used to determine risk, such as needle complement and crown density, were also shown to be subject to errors of judgement by persons appraising them.

agreement vs. accuracy

These studies, together with observations of the ratings applied in different localities, strongly indicate that part of the difficulty in applying the rating system lies in the lack of proper education. It has been observed that foresters and lumbermen attempting to apply the system with only a reading knowledge of it are prone to misinterpret the described characters. Tree classification systems are not an exact science, but the vagueness of the risk rating system's descriptive characters makes it more difficult to comprehend than the other ponderosa pine classification systems commonly used. While variable results may always be expected in applying the rating system because of differences in crown character appraisal, it is believed that much of the variability can be eliminated by proper indoctrination in the system.

With this in mind and to encourage a greater use of the risk rating system, the laboratory in 1948 began a program of education in the ponderosa pine portions of the region it serves. Part of this program is devoted to teaching the risk rating system and its application to foresters and lumbermen through the medium of training schools held at

different localities in the region. Two of these schools were held in 1950 under the joint sponsorship of the laboratory and the Office of Timber Management, Region One, Forest Service. The program of the schools was set up with the assistance of the training section of the Office of Personnel Management of the Forest Service regional office.

The schools offered an opportunity to study the effectiveness of the teaching methods used, and it is the purpose here to show how well the details of the risk rating system were assimilated by the trainees.

THE 1950 RISK RATING SCHOOLS

One school was held July 10-11, 1950 with classroom sessions in the auditorium of the Forest Service regional office at Missoula, Montana and field sessions on privately-owned land in the Deep Creek drainage of the Lolo National Forest. The second school was held July 13-14 with classroom sessions at the Rexford, Montana, elementary school and field sessions on federally-owned land in the Youngs Creek drainage of the Kootenai National Forest.

The training methods were identical for both schools. They followed a 4-point program suggested by the Forest Service regional training officer which, reduced to simplicity, consisted of 1) telling, 2) showing, 3) trying, and 4) checking. The initial half-day session was spent in the classroom and devoted to a lecture on the description of the ponderosa pine risk rating system, its development and uses. Colored slides from the Berkeley, California, laboratory were used to illustrate trees representing different risk ratings and tabular results of research work on the significance of the risk characters were presented to each trainee in mimeograph form.

This was followed by another half-day session in which all trainees were taken into a typical ponderosa pine forest where trees of different risk ratings had previously been selected. The trees were marked with large white spots with pressure paint guns, the number of spots corresponding to the risk rating of the trees. The crown characters supporting the risk rating of each tree were fully explained to the trainees. Emphasis was placed on getting each trainee to recognize and properly appraise these characters.

The second day was divided into two sessions, both held in the above-mentioned pine stands. In the first session each trainee was asked to risk-rate each of 50 numbered trees. The trees previously had been risk-rated by the laboratory and identified only by large numbers painted on several faces of the boles so that they could be seen from different directions. The trees had been selected to represent typical as well as atypical examples in each of the four risk ratings. Special attention was given to the selection of certain types of trees, stag-tops for example, for which the risk ratings are commonly misinterpreted.

The final session was spent in comparing the actual rating of each of the 50 test trees, as given by the laboratory, with the ratings given to it by the trainees. The crown characters that were the basis of the actual rating were then discussed so that trainees whose ratings differed could see where they had erred. Before adjourning the uses, benefits, and limitations of the risk rating system were summarized again. The timber management assistant from the Forest Service regional office then led a discussion to point out how the rating system meshed with existing silvicultural marking practices in ponderosa pine forests so that insect control could be achieved along with silvicultural objectives.

Though entirely unintentional, the two pine stands selected for the schools proved to be quite similar in many respects. Both predominantly overmature, they were remarkably related as to age distribution and stand density. The 50 test trees selected in each area were very much alike in the distribution, by number, of trees of different risk rating, as shown in Table 1. The Kootenai trees comprised a slightly heavier volume per acre than the Lolo test trees and the former trees were larger, averaging 1,086 board feet each as against 672 board feet for the Lolo trees.

Table 1. Distribution, by risk ratings, of ponderosa pine trees used in tests.

	Lolo test			Kootenai test		
Risk rating	No. of trees	Volume b.m.	% of stand	No. of trees	Volume b.m.	% of stand
1	6	4,490	13	6	5,580	10
2	25	17,420	52	25	31,160	57
3	14	9,340	28	15	13,940	26
4	5	2,350	7	4	3,600	7
	50	33,600	100	50	54,280	100

TRAINING RESULTS

The coincident similarity in risk rating between the pine trees in the Lolo and Kootenai test areas proved fortunate, for it made possible a comparison of training results in both areas. The results expressed in Tables 2, 3, and 4 are based solely upon the scores made by the trainees in risk-rating the 50 test trees in each of the two areas. In Table 2, it will be seen that the average percentage of trees correctly rated

by each of the two groups of trainees was quite similar, being 67 percent in the Lolo test and 65 percent in the Kootenai test. The Lolo group showed a wider spread between the minimum and maximum percentages of trees correctly rated than did the Kootenai group. The percentages ranged from 48 to 84 in the former group and from 56 to 80 in the latter.

The average percentage of trees correctly rated by each group was equivalent to that of persons experienced in the rating system as determined by Eaton in his 1941 study. Individual scores, however, ranged from those associated with inexperience in the use of the system to those expected from persons ranked as experts in its use by Eaton's findings. Though only 2 trainees in the Lolo group and 5 in the Kootenai group had had previous instruction in the risk rating system, there appeared to be no significant difference between the scores of those trainees with previous risk training and those without it, or between trainees currently engaged in timber sales or marking and those not so engaged.

The distribution of risk ratings applied to the 50 trees in the two tests by each of the trainees is summarized in Table 3. While the average of all the trainees in each of the two tests is quite close to the actual ratings shown at the head of each column, the ratings of the individual trainees showed variation from the actual; in some cases to a considerable degree.

The ratings of the trainees are better expressed in the manner shown in Table 3 than in Table 2, for, as Eaton points out, many of the errors in rating are shown to be compensating in the former tabulation and additive in the latter. The information contained in Table 3 is of greatest significance because it expresses more closely than the other tabulation each trainee's adeptness in applying the risk rating system to a given pine stand. These data indicate that the average trainee in each test group rated the test trees very close to their actual rating when considering the proportion of the total trees placed in each risk category. Following the tests the regional training officer expressed the opinion that the average trainee could satisfactorily apply the risk rating system on timber sales or wherever selection cuttings aimed to leave low-risk trees in the residual stands. The results expressed in Table 3 appear to bear this out.

The results of the trainees' test ratings were re-arranged again as shown in Table 4 to show the deviation in ratings applied to each tree in the test groups. Only for one tree in each group were all the trainees unanimous in their rating. In both instances the trees, a risk-1 and a risk-4, were at the opposite extremes of the risk evaluations where their determination was simplest. The undecisiveness was greatest in separating the risk-2 and risk-3 trees. This is

important to note, because in the application of the risk rating system in connection with sanitation-salvage logging for bark beetle control, this separation determines whether the tree is to be cut as a high-risk tree or left as a low-risk tree.

SUGGESTED IMPROVEMENTS IN TRAINING METHODS

The two schools were successful as a training medium if judged by the fact that the adeptness of the average trainee in risk-rating trees was akin to that of a person experienced in the use of the rating system as determined by Eaton. It was the consensus of those conducting the schools that the trainees had acquired a better understanding of the risk rating system and its attendant uses than they would have by studying the available literature on the subject alone. Finally, through the schools, the laboratory was able to acquaint the trainees with the most modern concepts of the use of timber management practices as an insect control device.

Notwithstanding these apparent successes, there is need for improvement in the training methods to 1) increase the average rating ability of all the trainees and 2) narrow the diverse opinion regarding the rating of individual trees. Just how this can be accomplished is perhaps best expressed by some recommendations contained in correspondence from Regional Training Officer Victor O. Sandburg to Assistant Regional Forester C. S. Crocker dated July 17, 1950 summarizing the conduct of the two schools. These include:

1) Allow more time in rating the practice trees before testing the trainees.

2) Show a more comprehensive series of colored slides of trees in this region representative of different risk ratings.

3) Install risk demonstration plots on all national forests or lands of the larger private timberland owners cutting ponderosa pine in quantity by selection methods. These could be used for initial training purposes as well as for periodic refresher courses or for reference by those constantly using the risk rating system.

4) Include in the material given to the trainees a handbook or chart illustrating the various visible features of the risk rating system.

It is hoped that the incorporation of these features in future schools will be justified in increasing the value and effectiveness of present training methods.

REFERENCES

1. Eaton, Charles B. 1942.

Variation in the application of tree classification systems to ponderosa pine. Unpublished report of the Bureau of Entomology and Plant Quarantine, Forest Insect Laboratory, Berkeley, California.

2. Salman, K. A. and J. W. Bongberg. 1942.

Logging high-risk trees to control insects in the pine stands of northeastern California. Jour. Forestry 40: 535-539.

3. Wygant, Noel D. 1942.

Accuracy of appraising needle complement per twig and needle length on ponderosa pine. Unpublished report of the Bureau of Entomology and Plant Quarantine, Forest Insect Laboratory, Berkeley, California.

Table 2. Percentage of trees correctly risk-rated by each trainee.

Lolo test		Kootenai test	
Trainee	Percentage of trees correctly rated	Trainee	Percentage of trees correctly rated
A	66	A	70
B	72	B	66
C	82	C	64
D	82	D	62
E	84	E	66
F	44	F	64
G	54	G	80
H	62	H	58
I	48	I	62
J	50	J	58
K	70	K	58
L	70	L	58
M	78	M	60
N	60	N	68
O	76	O	66
		P	78
		Q	66
		R	62
		S	60
		T	60
		U	70
		V	70
		W	62
		X	82
		Y	68
		Z	58
		A-1	56
		A-2	60
Averages	67		65

Table 3. Distribution of risk ratings applied to test trees by individual trainees.

Lolo test

Trainee	No. of trees — Risk 1	2	3	4
ACTUAL	6	25	14	5
A	12	19	14	5
B	8	20	14	8
C	3	27	12	8
D	3	26	14	7
E	7	23	14	6
F	10	29	8	3
G	13	18	10	9
H	3	22	16	9
I	7	18	16	9
J	1	17	21	11
K	5	24	13	8
L	3	29	11	7
M	8	24	13	5
N	12	24	12	2
O	10	24	12	4
AVERAGE	7	23	13	7

Kootenai test

Trainee	No. of trees — Risk 1	2	3	4
ACTUAL	6	25	15	4
A	6	24	16	4
B	6	24	16	4
C	7	19	20	4
D	7	19	20	4
E	8	15	22	5
F	11	15	19	5
G	7	21	18	4
H	2	25	15	8
I	5	24	12	9
J	6	26	14	4
K	15	24	10	1
L	15	24	10	1
M	6	28	13	3
N	6	30	13	1
O	12	19	14	5
P	7	24	15	4
Q	10	19	16	5
R	9	29	9	3
S	6	21	19	4
T	6	21	19	4
U	11	18	18	3
V	11	18	18	3
W	9	29	7	5
X	7	25	14	4
Y	7	28	14	1
Z	5	25	12	8
A-1	6	26	12	6
A-2	10	26	12	2
AVERAGE	8	23	15	4

Table 4. Summary of risk ratings applied to individual test trees.

Lolo test						Kootenai test					
		Ratings applied by 15 observers						Ratings applied by 28 observers			
		Risk						Risk			
Tree No.	Risk Rating	1	2	3	4	Tree No.	Risk Rating	1	2	3	4
1	2		11	4		1	1	23	5		
2	2		3	11	1	2	2		9	19	
3	3			10	5	3	2		27	1	
4	3	1	3	9	2	4	2	8	20		
5	1	4	10		1	5	2	11	17		
6	3			5	10	6	4		2	10	16
7	4				15	7	3			13	15
8	3		2	9	4	8	2		15	11	2
9	2	3	11	1		9	3		1	19	8
10	2	4	11			10	3			7	21
11	1	12	3			11	2	3	21	4	
12	2		14	1		12	3	1	8	18	1
13	3	1	5	8	1	13	2	2	26		
14	1	14			1	14	2	2	24	2	
15	4			1	14	15	3		6	17	5
16	2		11	2	2	16	1	28			
17	3		3	11	1	17	1	23	5		
18	2	2	12	1		18	2	15	13		
19	2		12	2	1	19	3		17	11	
20	4		1	6	8	20	3		7	21	
21	3		7	7	1	21	4		2	16	10
22	2	7	7	1		22	2	5	23		
23	2	2	12	1		23	2	2	6	16	4
24	2		4	7	4	24	3		13	15	
25	2		9	6		25	3		14	14	
26	2	1	14			26	3		13	15	
27	3		10	5		27	2	1	22	5	
28	2	6	8	1		28	2	5	23		
29	1	8	7			29	2		26	2	
30	2	2	13			30	3		12	16	
31	3		5	10		31	4			20	8
32	2		11	4		32	3	1		23	4
33	2	1	14			33	2	14	14		
34	2	3	11	1		34	4		1	13	14
35	2		4	11		35	2	1	27		
36	3		5	9	1	36	3		3	23	2
37	1	11	4			37	3		11	17	
38	3		2	10	3	38	3		11	15	
39	4			4	11	39	2	4	21	3	
40	3		1	9	5	40	2		15	13	

Table 4 Cont.

Lolo test					
Tree No.	Risk Rating	Ratings applied by 15 observers Risk 1	2	3	4
41	4			5	10
42	1	8	6	1	
43	3		7	8	
44	2	3	11	1	
45	3		4	11	
46	2	1	14		
47	2	3	8	4	
48	2	4	10	1	
49	2	4	11		
50	2		13	2	
A	1	9.5	5.0	0.2	0.3
V	2	1.8	10.4	2.5	0.3
E	3	0.1	3.9	8.6	2.4
R.	4	0.2	0.2	3.1	11.5

Kootenai test					
Tree No.	Risk Rating	Ratings applied by 28 observers Risk 1	2	3	4
41	2		16	12	
42	2	2	24	2	
43	1	22	6		
44	1	9	17	2	
45	1	21	7		
46	2	13	15		
47	2		15	11	2
48	2	2	26		
49	2	5	23		
50	2		17	11	
A	1	21.0	6.7	0.3	0
V	2	3.8	19.4	4.5	0.3
E	3	0.2	7.8	16.3	3.7
R.	4	0	1.3	14.7	12.0

A P P E N D I X

ROSTER - LOLO TEST*

1.	Corrick, Ernest	Forester, Lumber Dept., Anaconda Copper Mining Co., Bonner, Montana
2.	Christensen, George F.	Timber Management staff assistant, Colville National Forest, Colville, Wash.
3.	Dawson, Al	Forester, Lumber Dept., Anaconda Copper Mining Co., Bonner, Montana
4.	Fullerton, Neil	Timber management staff assistant, Cabinet National Forest, Thompson Falls, Montana.
5.	Harrison, Champ	Timber management staff, Bitterroot National Forest, Hamilton, Montana
6.	Haynes, George S.	Timber management staff assistant, Bitterroot National Forest, Hamilton, Montana.
7.	Johnson, Philip C.	Entomologist, Forest Insect Laboratory, Coeur d'Alene, Idaho.
8.	McKinsey, Robert	Forester, Montana Timber Co., Bonner, Montana.
9.	Robb, Walter L.	District Ranger, Lolo National Forest, Superior, Montana
10.	Robinson, Lester D.	District Ranger, Bitterroot National Forest, Darby, Montana.
11.	Roe, Arthur L.	Forester, Northern Rocky Mountain Forest and Range Experiment Station, Missoula, Montana.
12.	Sandburg, Victor O.	Training Officer, Regional Office, Forest Service, Missoula, Montana.
13.	Shultz, Edward L.	Timber management staff, Lolo National Forest, Missoula, Montana.
14.	Smart, Robert A.	District Ranger, Lolo National Forest, Nuson, Montana.
15.	Stoltz, George	Timber Management assistant, Regional Office, Forest Service, Missoula, Montana

*Not in order of trainee code letters in Tables 2 and 3.

ROSTER - KOOTENAI TEST*

1.	Ahlskog, Howard E.	Timber management staff assistant, Kootenai National Forest, Libby, Mont.
2.	Albert, E. Schuyler	District Ranger, Kootenai National Forest, Libby, Montana
3.	Cloninger, Russell T.	District Ranger, Kootenai National Forest, Fortine, Montana
4.	Ferris, S. M.	Entomologist, Dominion Entomological Laboratory, Vernon, British Columbia
5.	Flint, Alfred A.	Fire Control, range, and wildlife assistant, Kootenai National Forest, Libby, Montana
6.	Forse, Harry	District Forester, B. C. Forest Service, Nelson, British Columbia
7.	Fulton, Lester F.	Asst. Dist. Ranger, Kootenai National Forest, Fortine, Montana.
8.	Gillespie, Robert H.	Timber sales staff, Kootenai National Forest, Fortine, Montana
9.	Grambo, Ernest J.	District Ranger, Kootenai National Forest, Rexford, Montana
10.	Griffith, Richard D.	Forester, J. Neils Lumber Co., Libby, Mont.
11.	Hamor, Clark	Forester, J. Neils Lumber Co., Libby, Mont.
12.	Hatch, William A.	Timber sales project officer, Kootenai National Forest, Libby, Montana
13.	Johnson, Philip C.	Entomologist, Forest Insect Laboratory, Coeur d'Alene, Idaho
14.	Lewis, LeRoy W.	District Ranger, Kootenai National Forest, Warland, Montana
15.	Lyman, John R.	Asst. Dist. Ranger, Kootenai National Forest, Warland, Montana
16.	Mathers, W. G.	Officer In Charge, Dominion Entomological Laboratory, Vernon, B. C.

Kootenai Test Cont.

17.	McCrea, Ernest	Asst. Land Agent, Lumber Dept., Anaconda Copper Mining Co., Bonner, Montana
18.	Milodragovich, John R.	Asst. Dist. Ranger, Kootenai National Forest, Troy, Montana
19.	Neff, George	Land Agent, Lumber Dept., Anaconda Copper Mining Co., Bonner, Montana
20.	Parrish, Jack	Forestry staff, J. Neils Lumber Co., Libby, Montana
21.	Perry, Robert	Forester, Lumber Dept., Anaconda Copper Mining Co., Bonner, Montana
22.	Peterson, Henry A.	Timber sales staff, Kaniksu National Forest, Sandpoint, Idaho
23.	Pietz, Roy C.	Timber sales staff, Kaniksu National Forest, Bonners Ferry, Idaho
24.	Roe, Arthur L.	Forester, Northern Rocky Mountain Forest and Range Experiment Station, Missoula, Montana.
25.	Sullivan, Michael	Timber sales staff, Bitterroot National Forest, Hamilton, Montana
26.	Trousper, Thurman H.	District Ranger, Kootenai National Forest, Libby, Montana
27.	Welton, Earl H.	Timber sales project officer, Kootenai National Forest, Libby, Montana
28.	Grove-White, G.D.	Silviculturist, B. C. Forest Service, Kamloops, British Columbia

*Not in order of trainee code letters in Tables 2 and 3.